UNIVERSITI PUTRA MALAYSIA

STORMWATER QUALITY FROM THE SUNGAI LUI CATCHMENT, MALAYSIA

ABDUL HAMID.

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STORMWATER QUALITY FROM THE SUNGAI LUI CATCHMENT, MALAYSIA

By

ABDUL HAMID

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

2005

Dedicated

To

My father and mother, my father in law and mother in law, my brother and sisters, my late relatives and to my beloved wife Nigar Sultana Sehely and to my son Alvee Jawad Hamid

Abstract of the thesis presented to the Senate of the Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

STORMWATER QUALITY FROM THE SUNGAI LUI CATCHMENT, MALAYSIA

By

ABDUL HAMID

December 2005

Chairman: **Associate Professor Zelina Zaiton Ibrahim, PhD**

Faculty: **Environmental Studies**

River water is continuously being impacted by pollutants generated from the catchment. In particular, substantial amounts of pollutants can be introduced to the rivers during storm events. This study was carried out to investigate the influence of storm events on the water quality parameters of the forested Sg. Lui catchment. Stormwater samples were collected from the Sg. Lui for 21 storm events between January 2003 to January 2004. Discharge, electrical conductivity (EC), pH, dissolved oxygen (DO), turbidity, total suspended solids (TSS), total phosphorus (TP), ammoniacal nitrogen (AN) and 5-day biochemical oxygen demand (BOD_5) were measured from the stormwater samples. Descriptive and inferential statistical analyses were carried out for the parameters studied.

The storm events sampled from the catchment were found to represent the 24th to 88th percentile of the average daily discharge for a typical year. Total suspended solids and turbidity appeared to be the major pollutants to the Sg. Lui catchment. The

results indicated a dilution-mobilization sequence in the concentration of TSS, TP, AN and the BOD_5 during the rising and falling limbs of the event hydrograph. A late flushing of materials was also observed, where much of the load was transported in the later half of an event. Event mean concentrations (EMC) were calculated for TSS, TP, AN and BOD_5 for the catchment. Hydrometeorological conditions of the catchment were used to explain the differences in the EMC values for the different events.

This study revealed that the water quality of the Sg. Lui catchment is influenced by the hydrometeorological conditions of the catchment. Statistical analyses confirmed the representativeness of the flow and the EMCs calculated for the Sg. Lui catchment. Discrete sampling enabled the detailed analysis of the hydrographs, pollutographs and loadographs. This assisted in understanding the processes influencing the temporal variability of the flow and water quality of the catchment during storm events.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KUALITI AIR HUJAN DI KAWASAN TADAHAN SUNGAI LUI, MALAYSIA

Oleh

ABDUL HAMID

Disember 2005

Pengerusi: Profesor Madya Zelina Zaiton Ibrahim, PhD

Fakulti: Pengajian Alam Sekitar

Air sungai dicemari secara berterusan oleh bahan pencemar dari kawasan tadahan. Sebahagian besar bahan pencemar masuk ke dalam sungai terutamanya semasa kejadian hujan berlaku. Kajian ini dijalankan untuk mengkaji pengaruh kejadian hujan ke atas parameter kualiti air di kawasan tadahan Sungai Lui yang berhutan. Sebanyak 21 kejadian hujan disampel antara Januari 2003 sehingga Januari 2004. Kadar alir air, kekonduksian elektrik (EC), pH, oksigen terlarut (DO), kekeruhan, jumlah pepejal terampai (TSS), jumlah fosforus (TP), ammoniakal nitrogen (AN) dan keperluan oksigen biokimia 5-hari (BOD_5) telah diukur daripada sampel kejadian hujan tersebut. Analisis statistik diskriptif dan inferens dijalankan keatas parameter yang dikaji.

Kejadian hujan yang disampel didapati mewakili persentil ke-24 hingga ke-88 daripada purata kadar alir harian untuk tahun 'biasa'. Jumlah Pepejal terampai dan kekeruhan merupakan bahan pencemar yang utama bagi kawasan tadahan urutan Sungai Lui. Keputusan analisis menunjuk perubahan pencairan-pergerakan pada

kepekatan TSS, TP, AN dan BOD_5 semasa tungkai menaik dan menurun hidrograf kejadian hujan. Kadar pelepasan bahan diperhatikan di mana kebanyakan daripada beban muatan telah dipindahkan pada peringkat separuh masa akhir kejadian hujan. Pengiraan kejadian purata kepekatan (EMC) terhadap TSS, TP, AN dan BOD_5 telah dilakukan. Keadaan hidrometeorologi kawasan tadahan digunakan untuk menerangkan perbezaan nilai EMC bagi kejadian hujan yang berbeza.

Kajian ini mendapati bahawa kualiti air Sungai Lui dipengaruhi oleh keadaan hidrometeorologi kawasan tadahan. Penyampelan diskrit membolehkan analisis hidrograf, graf pencemaran dan graf beban muatan yang terperinci. Ini membantu dalam memahami proses-proses yang mempengaruhi perubahan berdasarkan masa bagi kadar alir dan kualiti air kawasan tadahan semasa kejadian hujan. Penganalisaan ciri-ciri statistik mengesahkan keupayaan kadar alir dan EMC yang di kira dalam kajian ini untuk mewakili keadaan kawasan tadahan.

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I certify that an Examination Committee met on 16 December 2005 to conduct the final examination of Abdul Hamid on his Doctor of Philosophy thesis entitled "Stormwater Quality from the Sungai Lui Catchment, Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Ahmad Makmom Abdullah, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Chairman)

Lai Food See, PhD
Associate Professor
Faculty of Forestry
Universiti Putra Malaysia
(Internal examiner)

Mohammad Ismail B. Yaziz, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Internal examiner)

Chan Ngai Weng, PhD
Professor
School of Humanities
Universiti Sains Malaysia
(External Examiner)

HASANAH MOHD. GHAZALI, PhD
Professor/ Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 19 JAN 2006

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee are as follows:

Zelina Zaiton Ibrahim, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Chairman)

Wan Nor Azmin Sulaiman, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Member)

Mohd Kamil Yusoff, PhD
Associate Professor
Faculty of Environmental Studies
Universiti Putra Malaysia
(Member)

AINI IDERIS, PhD
Professor / Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 07 FEB 2006

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Ahamid

ABDUL HAMID

Date: 14/01/2006

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